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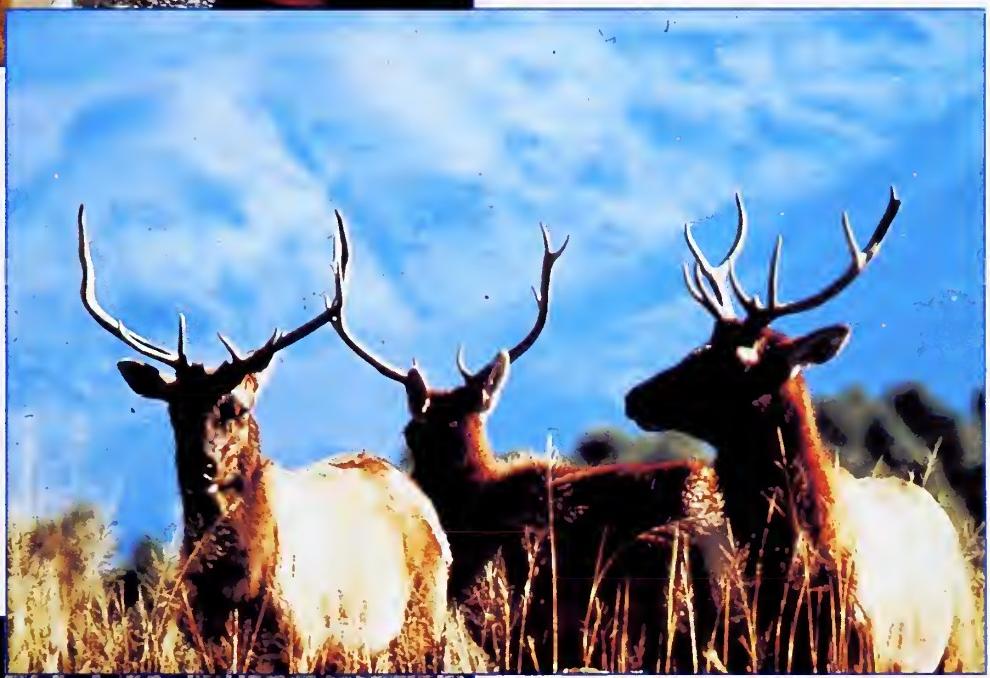
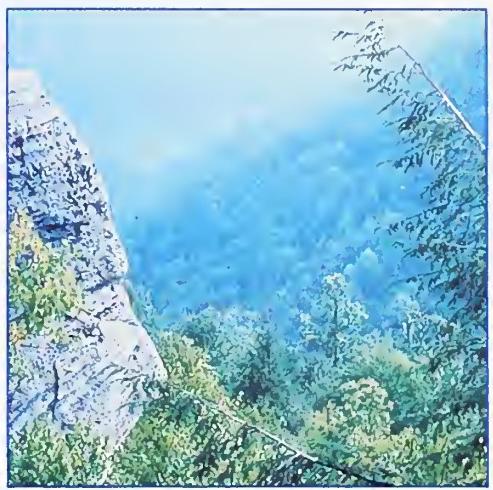
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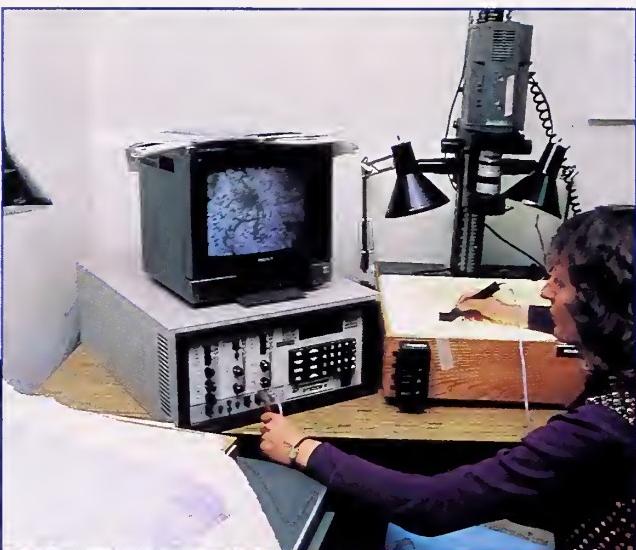


# Transferring Technology To Improve Forest Land Management



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# Transferring Technology To Improve Forest Land Management

**T**echnology transfer in the Forest Service is a term with many meanings but an activity with one purpose: to put into practice information and technology that will improve the management and utilization of our Nation's forests and rangelands. Often thought of as the application of research results — and specifically results produced by Forest Service researchers — technology transfer is much more. Employees from all branches of the Forest Service — Research, State and Private Forestry, and the National Forest System — who are seeking to discover ways to enhance and protect and utilize our natural resources are all doing technology transfer.



In fact, technology transfer is so much a part of our nature as an organization that we often don't recognize it. But we shouldn't be surprised when we recall that Gifford Pinchot's original charter for the Forest Service was to advise the owners of woodlands, including timber industries, about the proper care of their forest resources. Since then, Federal legislation, most recently the Technology Transfer Act of 1986,

has required us to strengthen our role in technology transfer, specifically targeting the commercialization of technology developed by the Forest Service.

In response to this legislation, the Forest Service has assigned the leadership of technology transfer to the Deputy Chief for State and Private Forestry. The Deputy Chief is charged with coordinating the national technology transfer program and serving as liaison with the Department of Agriculture and other Federal agencies. Operational responsibilities for technology transfer have been delegated to Station Directors, Regional Foresters, the Director of Northeastern Area State and



Private Forestry, and the Directors of the two Technology and Development Centers in Missoula, MT, and San Dimas, CA. Forest Service researchers are required to see that the results of their research are put into practice. The Cooperative Forestry Assistance Act of 1978 authorizes the Forest Service to reach out with new information and technology to Federal, State, and local governments so they can advance forest resource management on non-Federal forest lands. Natural resource professionals and technicians in the National Forest System are charged with seeking and passing on innovative ways to manage our Nation's Forests.



In 1988, the Forest Service Office of Program Development and Budget reported a significant upward trend in forest management efficiency over the last 2 years at the same time that budgets and staff were level or declining. These gains can in large part be attributed to the application of new technology in carrying out our mission. Much of this new technology comes from Forest Service Research Stations and Technology Development Centers. Much also comes from outside the Forest Service, reminding us that technology transfer is not only transfer of information and technology out from the Forest Service but also transfer into the Forest Service. We have a responsibility to continually look for new technology and information to bring back into the organization as well.

# **Delivering Information and Transferring Technology**

The Forest Service serves an extremely broad clientele, ranging from people who hunt and photograph wildlife on a national forest to researchers who investigate the quality of water in lakes and streams, to others who study special diseases in high-value pine tree species, and from snowmobilers and skiers to commercial industries who utilize timber in wood products or develop oil, gas, and minerals for use by the American public. This widely diverse clientele requires us to be creative in the mechanisms we use to put information and technology into practice. We use many different vehicles to deliver technology including:

- **The printed word — from scientific journal articles to conference proceedings, newsletters, and newspaper and magazine articles.**
- **The spoken word — from scientific symposiums to workshops, news conferences, phone consultations, and information hotlines.**
- **Television and radio.**
- **Videos, slide presentations, and posters.**
- **Field tours and demonstration forests.**
- **Pilot projects and patents.**
- **Special teams and employee exchanges.**

In 1988 we produced over 2,600 publications and articles, hosted over 600 conferences for audiences outside the Forest Service, and wrote over 60 formal plans for the purpose of transferring information and technology that would ultimately improve the management and use of our natural resources. In the last 5 years, we established or made use of over 300 demonstration forests and produced 350 videotapes and 250 software programs for that same purpose. We also hosted or sent 100 people on extended details last year as a means of transferring information into and out from the Forest Service.

Often the success of the transfer depends on choosing the appropriate vehicle for the audience in mind. In the

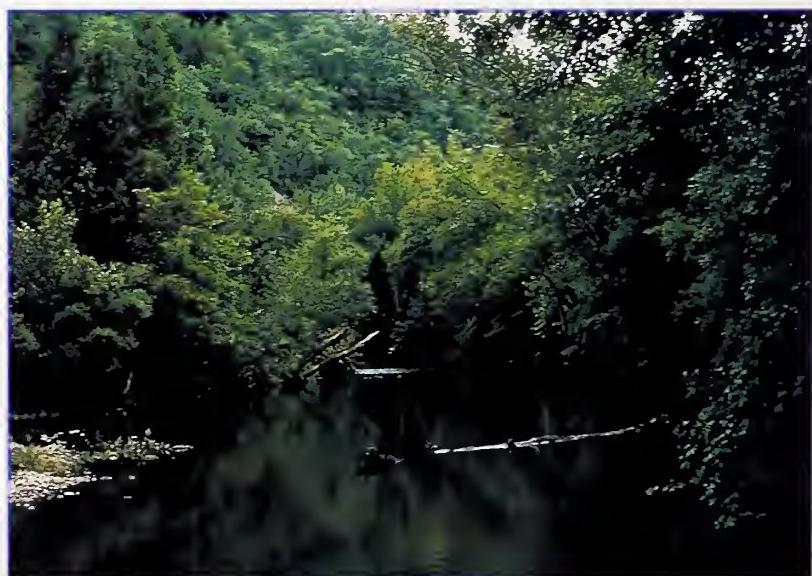


next few pages, we highlight some of our successes in technology transfer where we have used the right vehicle for the right audience.

## **Publications**

Written material is the most popular vehicle the Forest Service uses for transferring information and technology. A successful publication is one that the intended readers can easily find and understand. Journal articles suit scientists, field guides appeal to field foresters, and popular articles catch the eye of the public.

The recently published Central Hardwood Notes is a good example of a successful Forest Service publication. In this looseleaf reference book, over a half



*Proper management is the key to improving and protecting central hardwood forest.*

a century of research results and forest management experience are assembled for day-to-day use by natural resource professionals and knowledgeable landowners. The central hardwood forest is a vast area in the central part of the United States that produces high-value timber, abundant wildlife, and opportunities for millions of people to recreate. Extending from southern Minnesota down through Tennessee, and from eastern Kansas over through Pennsylvania, it is one of the largest forest areas in the country and contains about 100 million acres. Demand for the timber products alone from these forests is predicted to increase twofold to threefold by the year 2030. Proper management is the key to improving and protecting the central hardwood forest so that we can meet these and other demands.

Central Hardwood Notes lists 85 separate topics useful in managing the forest's multiple resources. Its authors include almost 100 scientists and practitioners, including technical experts from the Forest Service, State conservation agencies, universities, and industry from this region of the United States. The book was developed in direct response to forest managers and was cooperatively sponsored by the North Central, Northeastern, and Southern Forest Experiment Stations, and Northeastern Area State and Private Forestry.

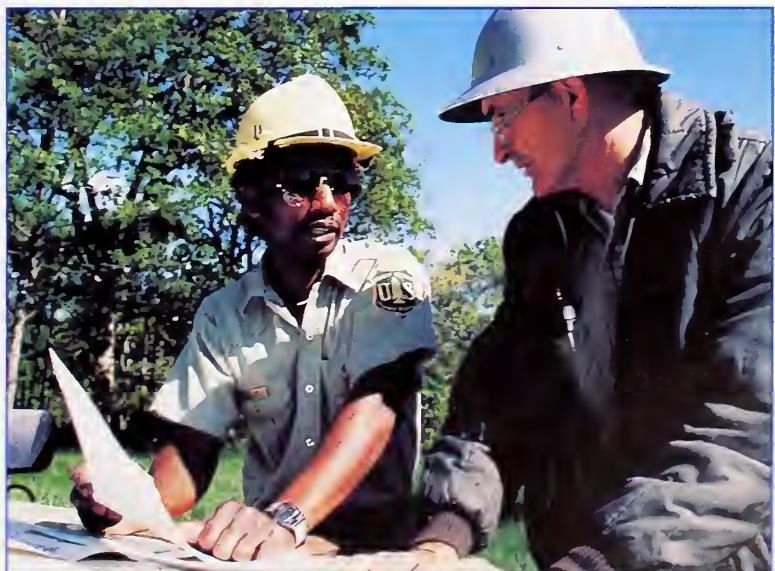
## Demonstration Forests

Demonstration forests are an excellent way to show forest landowners and managers the benefits of applying the best management practices on their lands. In 1988,



*The feller-buncher is popular for harvesting Southern pines.*

the Southeastern Forest Experiment Station established the Brender Demonstration Forest near Macon, GA, to show the effects of harvesting, regeneration, prescribed burning, and other management activities on the timber and wildlife resources of loblolly pine forests. The forest is used as an outdoor laboratory to demonstrate to forest owners the effects and benefits of good management of timberlands in the Southern States.



*Private landowners can consult with Forest Service specialists for planning and problem solving.*



*Brender Demonstration Forest is used as an outdoor laboratory to show Southern landowners the benefits of good management.*

Representatives from Federal and State agencies, industry, forestry associations, and landowner groups cooperated with the Southeastern Station to develop the Brender Demonstration Forest. Forest Service employees organize and schedule educational programs for various groups of landowners and managers, consultant foresters, and school classes, as well as interested members of the general public. Roads through the Forest are signed for self-guided tours and brochures are available for supplemental information.

Demonstrating the benefits of forest management to private landowners has become especially important because of recent concerns that southern forests may not meet future demands for wood, water, wildlife, and recreation. This stark outlook can be reversed with better multiresource management of forest lands. The likelihood that landowners in the South will better manage their forests is increased manyfold when they can see a well-managed forest. The Brender Demonstration Forest, along with other demonstration forests, goes a long way in helping landowners and forest managers see the difference.

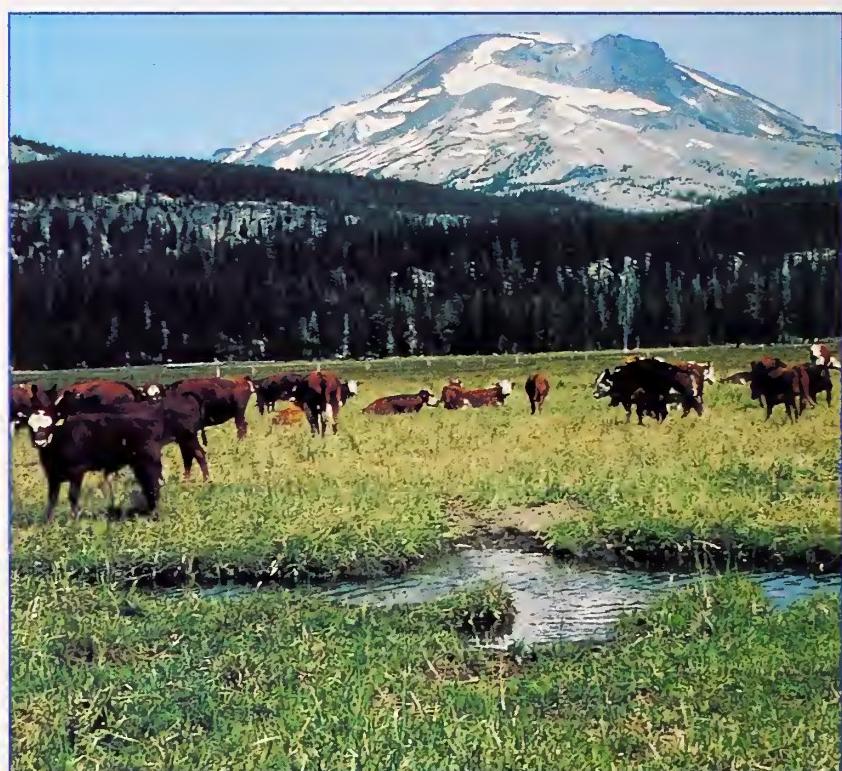
## Employee Exchanges

Often when intensive effort is needed to transfer some specific research results, dedicating a person to the task is the best vehicle for information transfer. In such cases, the Forest Service uses employee exchanges and temporary assignments to target the transfer of new information to a specific audience. Often the temporary assignment is a cooperative effort between the National Forest System and Research.

In 1987, the Pacific Northwest Region established a position with Research in La Grande, OR, to transfer research results on the management of cattle, deer, and elk in the Western United States to workers in the National Forest System. Mike Wisdom, a wildlife biologist, is the liaison between the research unit and the region, and also an important link with many other users of the wildlife research results such as ranchers, State wildlife organizations, and environmental groups. In the past 2 years this research unit has written over 24 articles and 10 news releases, hosted over 60 tours and presentations, given numerous radio and television interviews, and responded to over 2,000 telephone requests for information.



*Elk, deer, and cattle share summer range in the Western United States.*



The most obvious benefit of this employee assignment, as in many others, is well-targeted, timely transfer of research information. As important is the increased public support for research, an essential ingredient leading to successful technology transfer.

Employee exchanges can also have far-reaching international implications, as in a long-term partnership set up recently between the Forest Service, the United States Agency for International Development (USAID), and the Government of Honduras. Through the Honduran Forestry Development Project, the Forest Service is transferring a range of technology and information to Honduras over the next 3 years. The extensive experience of the Forest Service in the United States will be used to reorient the forestry profession in Honduras and the methods used to manage natural resource activities.



*Forest Service technology helps reduce waste during timber harvesting and milling in Honduras.*

Four long-term technology transfer specialists have been sent to provide leadership to the project, which consists of three main components: 1) financial and managerial strengthening of the Honduran Forestry Corporation, 2) forest management of a selected district to serve as a demonstration area for other districts throughout Honduras, and 3) strengthening of the forest industry. In addition, a training component emphasizes long-term educational opportunities for Honduran foresters in the United States and short-term training to participants from the private sector, the Honduran Forestry Corporation, and local communities.

## Special Teams

Although technology transfer is most often the result of comprehensive formal planning it sometimes results

from the assignment of specialists and researchers to ad-hoc teams for emergencies or emerging issues. For instance, the Wilderness Act of 1964 specified that natural processes should prevail in wildernesses as much as possible. After considerable discussion, the Forest



*Fire can play a natural role in wildernesses.*

Service determined that continued suppression of all fires in wilderness was not in the best interest of wilderness management. Thus, National Forest System and Research jointly funded a pilot project to determine how fire could play a more natural role in wilderness ecosystems.

A core team analyzed the issues, collected information to resolve the issues, prepared an operational fire management plan, and tested the plan through an implementation phase. The project transferred the technology to other wilderness managers and the National Park Service.

## Conferences

Conferences and workshops are a well-used, effective means of transferring technology within and outside the Forest Service. One excellent example is the recent conference, "International Symposium on Vandalism: Research, Prevention, and Social Policy," sponsored by



*Vandalism of structures and natural resources lowers the quality of life for all Americans*

the Forest Service Pacific Northwest Station, the University of Washington, and Vandalism Alert, Inc. The conference brought 250 resource managers, researchers, educators, law enforcement officers, attorneys, and business and community leaders together to share their knowledge about vandalism. Over 50 speakers focused on concerns such as vandalism of cultural resources, vandalism in recreational settings, and urban vandalism. In addition to the talks, participants demonstrated methods for controlling vandalism.

Vandalism is a pervasive problem that is costing the United States billions of dollars every year and lowering the quality of life for all Americans. This conference went a long way toward improving our understanding of vandals, methods for preventing vandalism, and our knowledge about apprehending vandals. All this means fewer dollars spent on



*Whitebark pinenuts are a major source of food for grizzly bears.*

repairing recreational facilities, fewer crimes against recreational visitors, and better control over the destruction of irreplaceable cultural resources.

In another example, Richard Kracht, forest silviculturist on the Gallatin National Forest, sponsored a workshop on the management of whitebark pine at Montana State

University with participants from the National Forest System, Forest Service Research, local universities, the Montana Department of Fish, Wildlife and Parks, the U.S. Fish and Wildlife Service, and various interest groups. Whitebark pine nuts are critical elements of the diet of grizzly bears. The workshop concluded that although there was a considerable body of knowledge, it was not readily available in the literature normally used by resource managers and specialists. A second symposium, "Whitebark Pine Ecosystems: Ecology and Management of a High Mountain Resource," was held at Montana State University, Bozeman, MT, 2 years later. State-of-the-art information on all aspects of whitebark pine ecosystems was presented in invited and voluntary papers and posters. The proceedings are to be published by the Intermountain Research Station as a General Technical Report.

## Software

In this age of electronics, computer software is an ever-increasing tool for managing information. Research information once published as words and equations on paper now appears as computer models and is distributed on floppy disks. Natural resource managers are becoming as comfortable in front of a computer terminal as they have been reading reference books and journal articles in the past.

The Forest Service has used software very effectively as a technology transfer vehicle for forest growth and yield models. These models predict forest growth under various management strategies and often evaluate the financial wisdom of the alternatives. On computer terminals, foresters can visualize how actual stands of trees will

that people — national forest managers to private landowners — are making better informed decisions about the care of the Nation's forests.

## Videos

As VCR's become common in American homes, the videotape is emerging as an effective technology transfer tool. Not only do videos reach into the homes of forest users, but they provide a convenient medium for training Forest Service employees.

Eleven avalanche deaths in the Rocky Mountains in 1986 brought home the need for greater awareness of the hazards of winter backcountry travel. Out of that awareness has come the message for an innovative



*Digitized mapping allows resource specialists to inventory and evaluate natural resources.*

appear 20 years from now. They can cut, kill, and plant trees and then grow the forest to see the results on their screens. This look into the future gives foresters an excellent basis for the decisions they make for the management of real forests.

The Forest Service has developed growth and yield software for nearly every region of the country. Some of the most familiar models are TWIGS, Prognosis, and DFSIM. The Forest Service is not the only benefactor of these growth simulators: models are used by every sector of the natural resource community, which means



*Winter recreationists risk the danger of avalanches.*

videotape designed for outdoor recreationists and recreation managers. The video clearly recognizes winter dispersed recreation as an appropriate and growing activity and offers the basic tools for people to use in assessing hazards and making safe choices about how to conduct themselves in the winter outdoor environment.

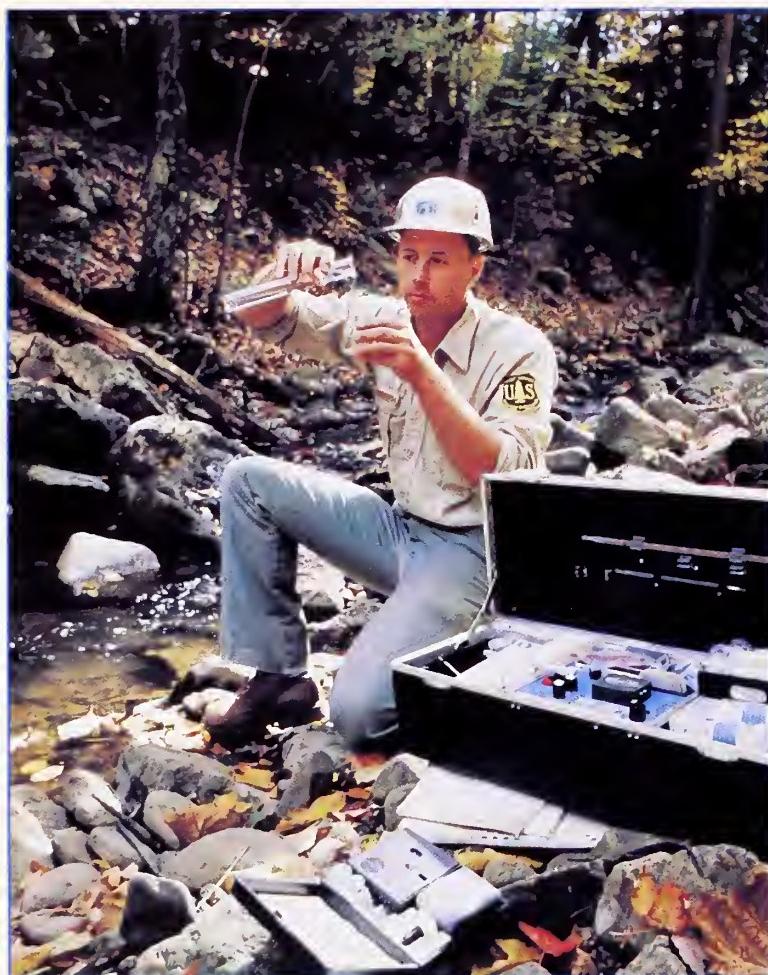
Through the Challenge Cost-Share Program, the Forest Service Rocky Mountain Region cooperated with The Gates Foundation, the American Association of Avalanche Professionals, and the Colorado Mountain Club Foundation to support the \$90,000 production cost and to market the videotape (also available in

16-mm film). It has been made available to most national forests and all school districts in Colorado and is sold in a dozen sporting good stores and other retail outlets in the Western United States and Canada.

As a result of this technology transfer, we can expect greater public awareness of avalanches and their dangers and fewer injuries and fatalities from winter backcountry recreation.

## Field Tours

Sometimes the key to transferring technology is using a variety of techniques. Often, resource managers are much more receptive to new concepts and techniques when written material is supplemented with field tours. Recently, a team of resource specialists on the Nez



Maintaining good stream water quality for fisheries is an important aspect of road building and upkeep.

Perce National Forest in the Northern Region worked with a research hydrologist from the Intermountain Station to develop a set of management practices to reduce the impacts of road construction and road main-

tenance on the environment. Their approach, "A Concept in Harmony," is a unique combination of engineering practices, design specifications, and administration that, when taken together, create a cohesive road management program blended with other resource management objectives.

Research papers have been published to support these concepts, but field tours of the study area have been the key to bringing many resource managers to understand and adopt the new practices. Staff members from the Nez Perce National Forest and Forest Service Research have taken slide shows to many meetings in the region to generate interest in the field tours. Much interest has been shown by agencies outside the Forest Service, for example, the Columbia River Intertribal Fish Commission, as well as timber industries and State natural resource agencies, with additional support from local environmental groups. Developmental activities that were previously not environmentally feasible now meet environmental standards and can proceed without adverse effects.

## Planning for Technology Transfer

The key to successful technology transfer is providing information that is needed in a form that best reaches the user. For that to happen, potential users must be involved in the decisions about what research we do and about how we intend to care for the Nation's forests. Potential users must also have a role in deciding what mechanisms most effectively convey the new information and technology.

Technology transfer planning that involves potential users from the beginning ensures success. In many instances, written and approved technology transfer plans are very effective tools for assuring users ownership in the product and commitment to the project. The approval signatures provide the organizational commitment needed to carry the project through to completion.

In 1988 the Forest Service entered into 60 formal technology transfer projects, ranging from new methods in predicting the growth of loblolly pine to introduction of a geographic information system (GIS) to implementation of



*Timber bridges are less expensive and easier to construct than conventional highway bridges.*

a satellite-based global positioning (GPS) system. A good example is the Forest Product Laboratory's timber bridge project. In this case, a 5-year plan was prepared for the transfer of laminated wood bridge deck technology in response to the Federal Highway Administration's (FHA) call for ways to improve secondary and rural road bridge conditions. The FHA contends that 80 percent of the rural bridges in 10 States are either structurally or functionally deficient and estimates replacement costs at \$40 to \$50 billion. Wood material could be used for all or part of the construction, saving one-third to one-half the expense.

The technology transfer plan involved many cooperating agencies to identify the goals for the project, the audience, the role of each cooperator, and the estimated costs and time schedule. This particular project conveyed the message using custom-built bridges, conferences, workshops, videotapes, exhibits, training sessions, a design manual, and other publications. Many State, Federal, and County road departments, individual consultants, and engineering firms now know how to construct and utilize

timber bridges. The magnitude of this project made the technology transfer plan a necessity, but many smaller projects involving fewer cooperators benefit in the same way from user involvement and commitment up front.



*Forest Service research on exterior wood finishing provides practical information on paint formulation and finishing problems.*

## **Outstanding Contributors Given Awards**

In 1988, Chief Robertson presented three cash awards to Forest Service employees who made outstanding contributions in the area of technology transfer. These awards were to underscore the importance the Forest Service places on technology transfer activities.

### **Wood Finishing Technology**

Dr. William C. Feist, researcher at the Forest Products Laboratory, has led a research and technology transfer program that has touched the lives of more citizens more directly than probably any other in the Forest Service. His work on exterior wood finishing, painting, and staining has saved countless homeowners dollars and personal time by preventing ruined paint jobs and extending the life of wood structures.

In a multidimensional technology transfer program, Feist worked with State and Private Forestry and extension specialists to develop 100 technical publications plus numerous practical articles and slide and video presentations. He typically responds to

over 500 personal inquiries a year and gives many lectures to user groups. Many of his articles are used as basic information sources by the paint and wood industries. In 1986, Feist compiled the results of more than 65 years of continuing research at the Forest Products Laboratory on exterior wood finishing in *Finishing Wood Exteriors: Selection, Application, and Maintenance*, Agriculture Handbook 647. To date over 20,000 copies have been sold.



*Three types of substitute earth anchors have been developed: arrowhead, soil toggle, and manta ray.*

Through this wide range of technology transfer activities, Feist has provided valuable information to private citizens, the wood products and finishing industries, architects, and many others. In addition, he frequently serves as a technical expert for the National Forest System, providing practical information on finishing problems and paint formulations.

## The Substitute Earth Anchor System

A team of people including Briar Cook and Bob Simonson from the San Dimas Technology Development Center, Don Studier from the Washington Office Timber Management Staff, and Ron Copstead from the Pacific Northwest Station received their award for the development and application of the substitute earth anchor system (SEAS). The Forest Service was interested in finding an alternative to using stumps as an anchor point for cable logging operations. The lack of suitable anchor points often has meant forgoing timber harvest opportunities or installing complicated and expensive alternative equipment. SEAS is easy to install, has met all safety standards, and is now readily available on the commercial market. The SEAS team used a

variety of methods in transferring this new technology to the National Forest System and private industry. The work was initiated under an agreement with a private engineering company to fabricate and demonstrate various anchor concepts. The Occupational Safety and Health Administration (OSHA) was a key cooperator. Team members used field demonstrations, logging conferences, news releases, research and popular articles, and a final training session that included the development of an installation guide.

This new technology increases the Federal timberlands in the Pacific Northwest available for harvest by private industry contractors by 15 percent. It also means an increase in the Federal funds collected from those sales returned to State and local governments. Loggers operate in all areas more safely and efficiently because stump availability no longer restricts the location of logging equipment. Beyond that, the military and the



*Field demonstrations have shown the benefits of using earth anchors as alternatives to using stumps in guying cables.*

power and electronics industries in the United States have adopted the SEAS for their own unique applications in guying masts and electronic towers and wherever a stable anchor point is required and there are no suitable natural features.

## National Computer Network

Clyde Shumway, Director of the Computer Sciences and Telecommunications Staff in Washington, DC, received his award for exceptional leadership in transferring new office automation technology into the Forest Service. At the time the Data General computer system was

introduced into every Forest Service office nationwide, it was the largest distributed computer network ever installed. Successful implementation required insight into the organization's culture, a sound knowledge of the technology, and a solid grasp of new and innovative approaches to technology transfer techniques.

In the first 2 years of Data General operation, the Forest Service increased its productivity by saving almost 1/2 million hours of employee time. Mailing costs for the Washington Office alone were cut \$1.5 million, and payroll processing costs have been cut \$3.5 million per year. Over the last 5 years, organizational productivity has increased by 17 percent, even with 25 percent fewer employees. It is estimated that the Forest Service saves \$500 for every \$100 spent on the computer system.

Shumway had the major responsibility for Forest Service wide-leadership in the introduction and operation



*The Forest Service national computer network has changed the way we do business.*

of the Data General in the Forest Service. He worked closely with the Data General Corporation, congressional staffs, the Office of Management and Budget, USDA, and the National Finance Center to develop an implementation plan. He and his staff implemented the plan, contracting for the purchase of hardware for all Forest Service offices, developing hardware and software standards for the agency, training field office systems managers, and testing new systems. No new technology has influenced Forest Service employees to such a degree as the Data General system, and Shumway's leadership was a very important element in the system's success.

## What Does the Future Hold?

Technology transfer in the Forest Service is as old as the agency itself. The original charter of the Forest Service was developed around the notion of transferring technologies. Back in 1910 when 45 young researchers began



work at the new Forest Products Laboratory in Madison, WI, the message was clear: "to explore the field of wood utilization for the benefit of people...and to develop new uses of wood." The 1928 Forest Service manual even outlines some of the concepts we have today. Our present and our future are well grounded in our history

One major purpose of Forest Service technology transfer is to strengthen the Nation's economy by enhancing the application of Forest Service technology and expertise to the needs and opportunities provided by businesses, universities, State and local governments, Native Americans, Alaska Natives, and Federal agencies. Over the years we have learned that if successful, technology transfer will ultimately result in product and process improvements, increased service, cooperative efforts and new products and processes for the marketplace. The future will bring a strengthening of projects designed especially for increasing efforts, at commercializing Forest Service technology in the private sector.

We also use the technology transfer program to take advantage of new opportunities in the management of our Nation's forest and rangeland resources. We will strengthen the use of the program to help us find ways to reconcile the requirements of forest conservation with the needs of people and to form the basis of partnerships between researchers and users, government and industry, special interests and managers.

